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Migratory Waterfowl Habitat Selection in Relation to Aquatic Vegetation

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PURPOSE: This technical note describes studies of environmental conditions and habitat quality of replicated pond ecosystems dominated by populations of exotic plants or mixed communities of native aquatic plants. Study ponds were similar in depth, size, and shape, as well as in (initial) water and sediment composition. One component of these studies included evaluation of migratory waterfowl utilization of pond habitats based upon vegetation community composition.

Aquatic vegetation is a critical food source for many migratory waterfowl, and numerous studies have shown that water bodies with abundant aquatic plants receive the greatest use (White and Malaher 1964, Hobaugh and Teer 1981, Johnson and Montalbano 1989). In cases where aquatic vegetation is restricted or absent, waterfowl use is generally low (Heitmeyer and Vohs 1984). Additionally, declines in migratory waterfowl have been correlated with loss of submersed aquatic vegetation in numerous water bodies (Jorde et al. 1995, Orth and Moore 1981, Haramis 1991).

The benefits of aquatic vegetation for waterfowl may be dependent upon the species of vegetation present, with studies showing that migratory waterfowl appear to prefer native aquatic plants as opposed to exotic species (Smith 2001, Benedict and Hepp 1996). Although reasons for this preference are not clear, native plants are held to be more nutritious than exotic species and are therefore more valuable to waterfowl (Paulus 1982, Sudgen 1973). Native aquatic plants may also provide better habitat for invertebrate recruitment, an important supplemental food source for many waterfowl species (Keast 1984). Conversely, invasion and establishment of less beneficial exotic aquatic plants such as hydrilla (*Hydrilla verticillata*) and Eurasian watermilfoil (*Myriophyllum spicatum*) may limit waterfowl utilization of water resources.

OBJECTIVE: The objective of this study was to discern migratory waterfowl habitat selection between native and exotic aquatic plant communities. Plant communities investigated included a high-diversity native community and two low-diversity exotic communities, one dominated by hydrilla, and one dominated by Eurasian watermilfoil (herein referred to as watermilfoil).

METHODS: The study was conducted during the winter of 1999-2000 at the U.S. Army Corps of Engineers' Lewisville Aquatic Ecosystem Research Facility (LAERF) in Lewisville, Texas. LAERF is located immediately south of Lewisville Lake, an 11,300-ha reservoir built in 1949 for flood control and water supply. LAERF is isolated from urbanization by a surrounding 800-ha tract of land dedicated to environmental education, preservation, and research. The facility is located along the boundary of the Eastern Cross Timbers, Fort Worth Prairie, and Blackland Prairie vegetation regions (Gould 1975, Diggs et al. 1999) of Denton County and is within the Trinity River basin. LAERF houses 55 earthen, clay-lined ponds ranging in surface area from 0.2- 0.8 ha.

Variables that have been correlated with waterfowl habitat selection were eliminated by the study design, which utilized distinct plant communities contained within discrete ponds. Proximity to a large body of water is often correlated to waterfowl pond selection, and in this project, all study

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ponds were located on one property adjacent to a large reservoir. Ponds were gravity fed from the same source, yielding similar initial water quality parameters such as pH, alkalinity, dissolved oxygen, conductivity, and turbidity. Physical parameters such as size, depth, slope, and shoreline development indices were also similar among ponds.

Three aquatic plant community structures were examined, including one dominated by hydrilla (three ponds) and one dominated by watermilfoil (three ponds), with pond margins of both dominated by jointgrass (*Paspalum distichum*). The third community was comprised of native species (four ponds), including American pondweed (*Potamogeton nodosus*), Illinois pondweed (*P. illinoensis*), wild celery, water stargrass (*Heteranthera dubia*), southern naiad (*Najas guadalupensis*), horned pondweed (*Zannichellia palustris*), muskgrass (*Chara vulgaris*), and white water lily (*Nymphaea odorata*). Marginal species in these communities included jointgrass, bulltongue (*Sagittaria graminea*), softstem bulrush (*Scirpus validus*), several spikerushes (*Eleocharis* spp.), tall burhead (*Echinodorus berteroi*), and pickerelweed (*Pontederia cordata*).

Ocular waterfowl counts with species identification were conducted at (approximately) three-day intervals from mid-October 1999 through early April 2000. Counts were conducted within 2-1/2 hr of sunrise. Observations were logged while driving around the ponds with the aid of binoculars as necessary. Each bird was only counted once at each inventory, and flushed birds were not counted again at the pond in which they landed.

It was assumed that significant differences in migratory waterfowl counts among ponds were indicative of habitat preference by the birds. Kruskal-Wallace nonparametric analysis of variance (α=0.05) was performed on counts to compare frequency of occurrence among ponds; when differences were detected, comparison of mean ranks was performed to group statistically similar ponds.

RESULTS AND DISCUSSION: Between mid-October 1999 and early April 2000, 37 surveys were conducted,with 3,976 birds recorded. Eleven species representing two groups of migratory waterfowl were observed during this period: puddle ducks and diving ducks. Puddle ducks (Family *Anatidae*, Subfamily *Anatinae*) are largely freshwater species that feed at the surface or by tipping up (with heads below the surface) in shallow water; most species feed heavily on aquatic or flooded terrestrial vegetation. Diving ducks (Family *Anatidae*, Subfamily *Aythyinae*) commonly occur in freshwater or saltwater and feed by diving beneath the surface; most species feed on aquatic vegetation and/or invertebrates. Total counts of these birds from all ponds are given in Table 1.

Migratory waterfowl showed clear preferences for ponds dominated by native vegetation over those dominated by watermilfoil or hydrilla. Of the total count, 73 percent occurred in native ponds, 4 percent occurred in watermilfoil ponds, and 23 percent occurred in hydrilla ponds (Figure 1). Counts were significantly higher in all but one native pond (pond 28), which may have been due to slow establishment of plants in that pond: coverage was near 100 percent, but plants had not developed surface canopies as they had in other native ponds, and for the most part remained about 25 cm below the water surface. Waterfowl shunned watermilfoil ponds: a relatively high count in one (pond 39) was believed to be due to the presence of an American pondweed colony in that pond (covering an estimated 20 percent of the total pond area). Counts in hydrilla ponds were moderate, but well below that of most native ponds. A relatively low count from one hydrilla pond (20) was believed to be due to its proximity to a power line, on which hawks frequently perched.

Table 1
Migratory Waterfowl Observed in 10 Experimental Ponds at Lewisville, Texas Between October 18, 1999 and April 3, 2000 (Average count per observation period was 107 birds)

Common name	Scientific name	Total count	Percent total count
Mallard	*Anas platyrhynchos*	754	19.0
Gadwall	*A. strepera*	1,041	26.2
Northern pintail	*A. acuta*	12	0.3
Blue-winged teal	*A. discors*	110	2.8
Green-winged teal	*A. crecca*	53	1.3
Cinnamon teal	*A. cyanoptera*	37	0.9
American widgeon	*Mareca americana*	935	23.5
Northern shoveler	*Spatula clypeata*	229	5.8
Bufflehead	*Bucephala clangula*	191	4.8
Lesser scaup	Aythya affinis	53	1.3
Ring-necked duck	*A. collaris*	514	12.9
Redhead	*A. americana*	47	1.2
Total		**3,976**	

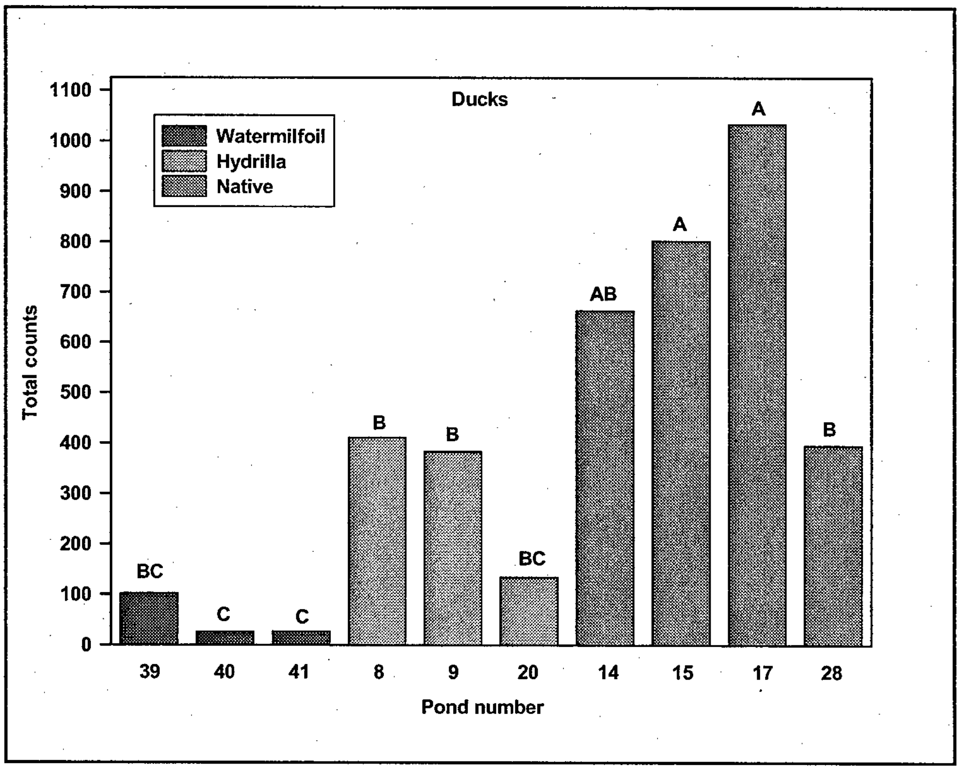

Figure 1. Migratory waterfowl (duck) counts were highest in native ponds and lowest in watermilfoil and hydrilla ponds, indicating preference for habitat provided by native plant species

Puddle Ducks. Puddle ducks were the most frequently observed (79.7 percent) migratory waterfowl group, with eight species recorded, including mallards (*Anas platyrhynchos*), gadwall (*A. strepera*), northern pintail (*A. acuta*), green-winged teal (*A. carolinensis*), blue-winged teal (*A. discors*), cinnamon teal (*A. cyanoptera*), northern shoveler (*Spatula clypeata*), and American widgeon (*Mareca americana*). Of the 3,170 puddle ducks observed, 70 percent were in native ponds, 4 percent were in watermilfoil ponds, and 26 percent were in hydrilla ponds (Figure 2). High frequencies of puddle ducks in native ponds indicated preference for native vegetation over exotic vegetation. Divergence in frequencies in ponds 20, 28, and 39 relative to ponds with similar vegetation were attributable to reasons provided in the previous section.

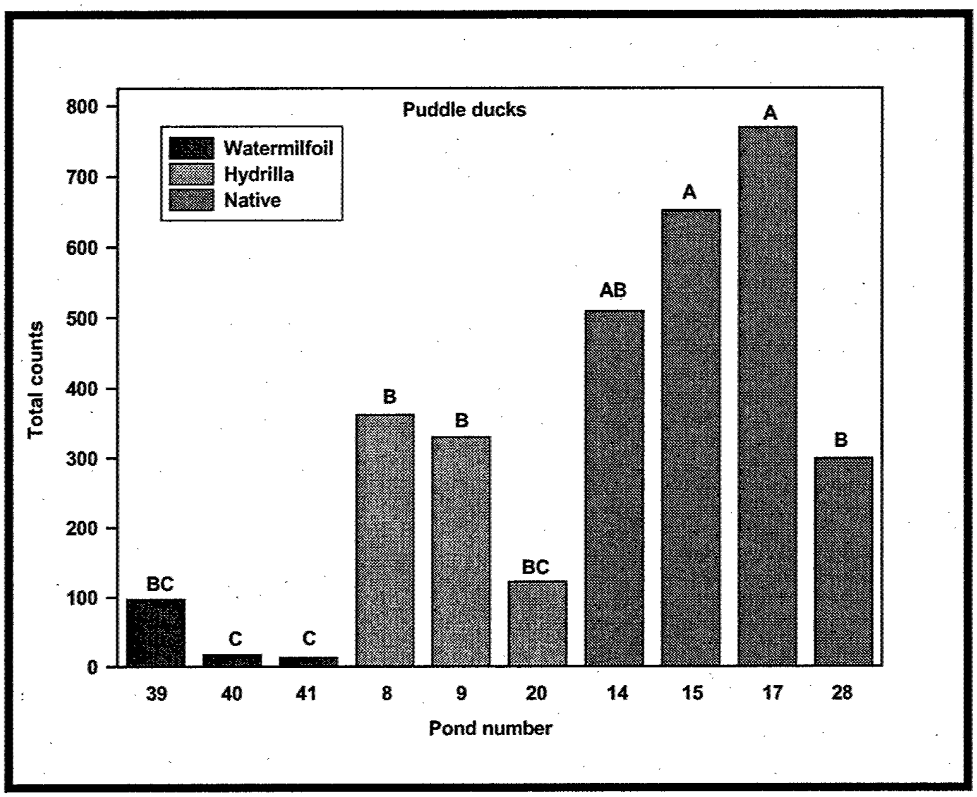

Figure 2. In general, puddle duck counts were highest in native ponds and lowest in watermilfoil ponds

Figures 3 through 10 provide counts of eight puddle duck species observed during the study period. Puddle duck counts in native plant ponds were high, with all species recorded from all ponds, generally at the highest frequencies for each. One species (northern pintail) was observed only in native ponds.

Watermilfoil pond selection by puddle ducks was low. Two species were observed in all watermilfoil ponds, whereas four species were recorded in pond 39, which supported a significant American pondweed colony. Four puddle duck species were not recorded at any watermilfoil ponds. Hydrilla pond selection by most puddle duck species was moderate. Three species occurred in all hydrilla ponds, and six species occurred in at least one hydrilla pond. Two species were not observed in hydrilla ponds. Relatively high counts (similar to counts from native ponds) of American widgeon and northern shovelers occurred in two hydrilla ponds (8 and 9).

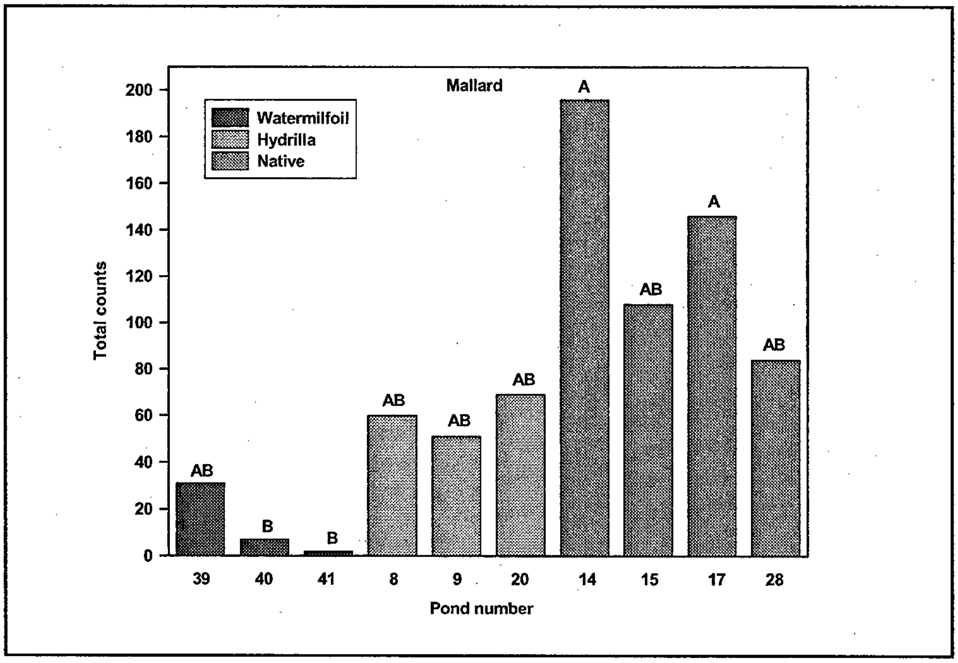

Figure 3. Mallard counts were highest in native ponds and lowest in watermilfoil ponds. A relatively high count in pond 39 (compared with 40 and 41) was likely due to a colony of American pondweed in that pond

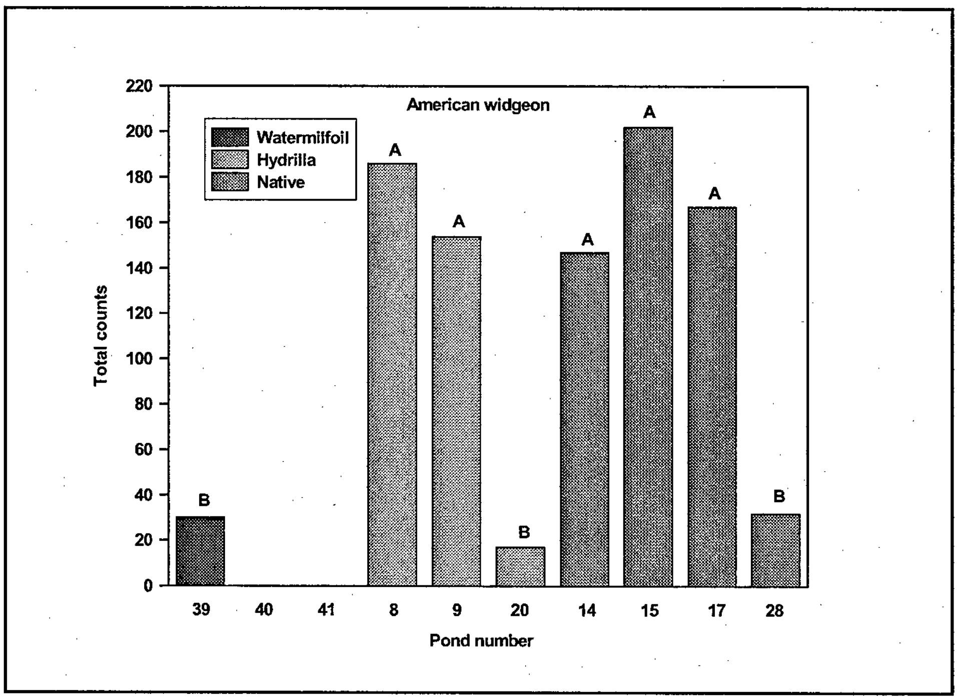

Figure 4. American widgeon counts were highest in native and hydrilla ponds; the species was not observed in watermilfoil ponds that did not also support native vegetation

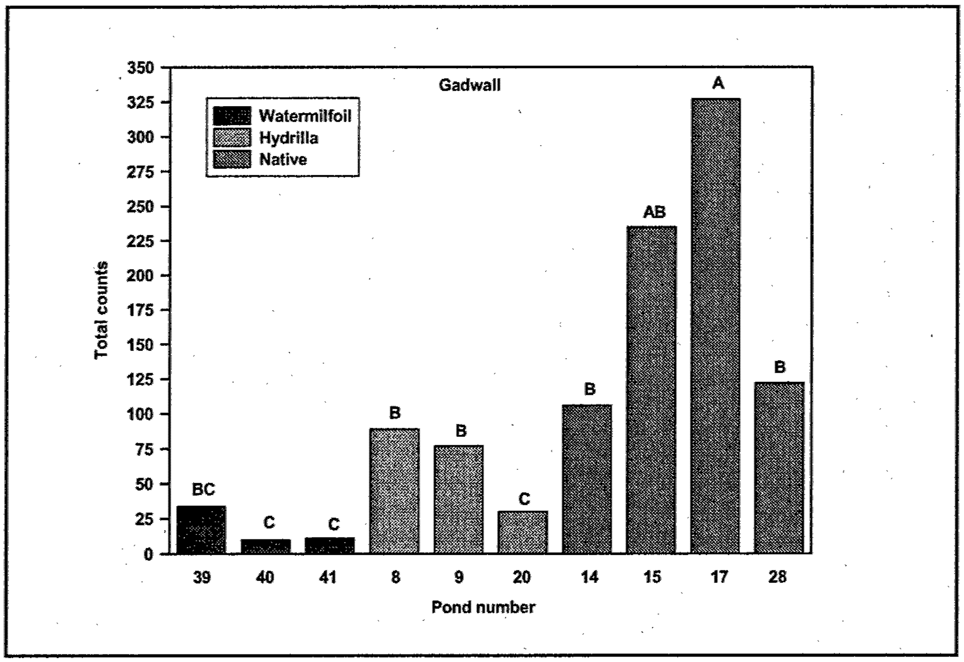

Figure 5. Gadwall counts were highest in native ponds and lowest in watermilfoil ponds. A relatively high count in pond 39 (compared with 40 and 41) was likely due to a colony of American pondweed in that pond

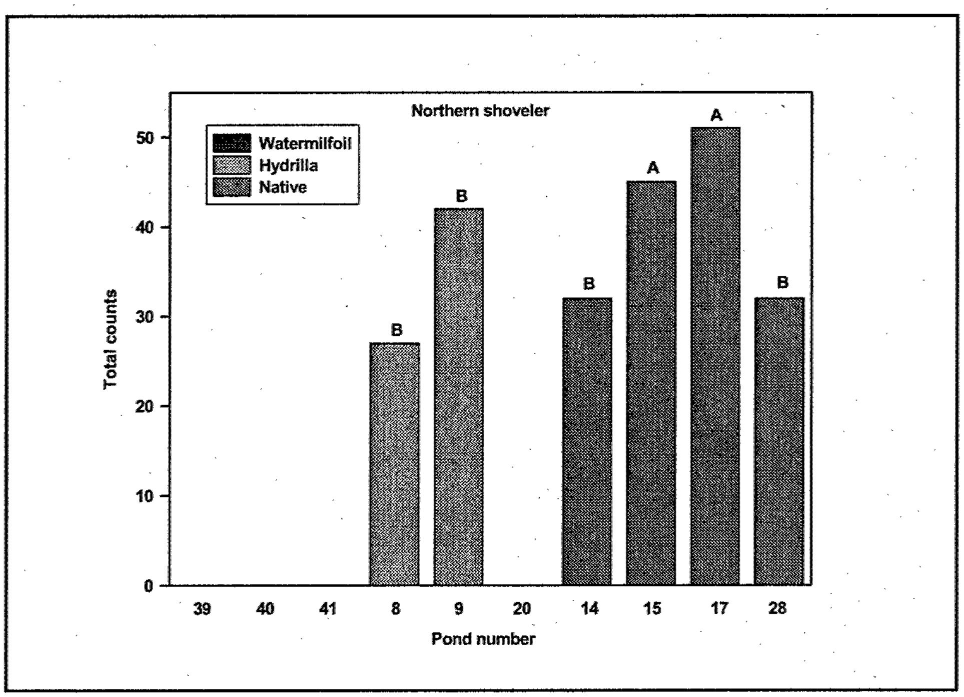

Figure 6. Northern shoveler counts were highest in native ponds; the species was not observed in watermilfoil ponds. Absence from one hydrilla pond (pond 20) was believed to be due to proximity of power lines used as perches by hawks

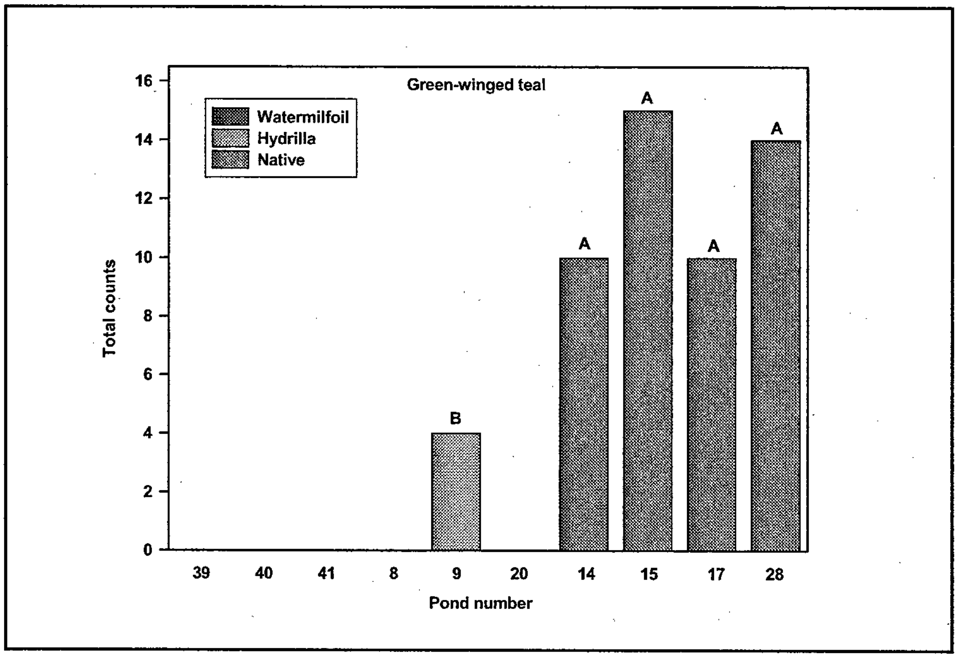

Figure 7. Green-winged teal counts were highest in native ponds; the species was not observed in watermilfoil ponds or two hydrilla ponds. Birds observed in pond 9 (a single observation) were associated with shoreline vegetation.

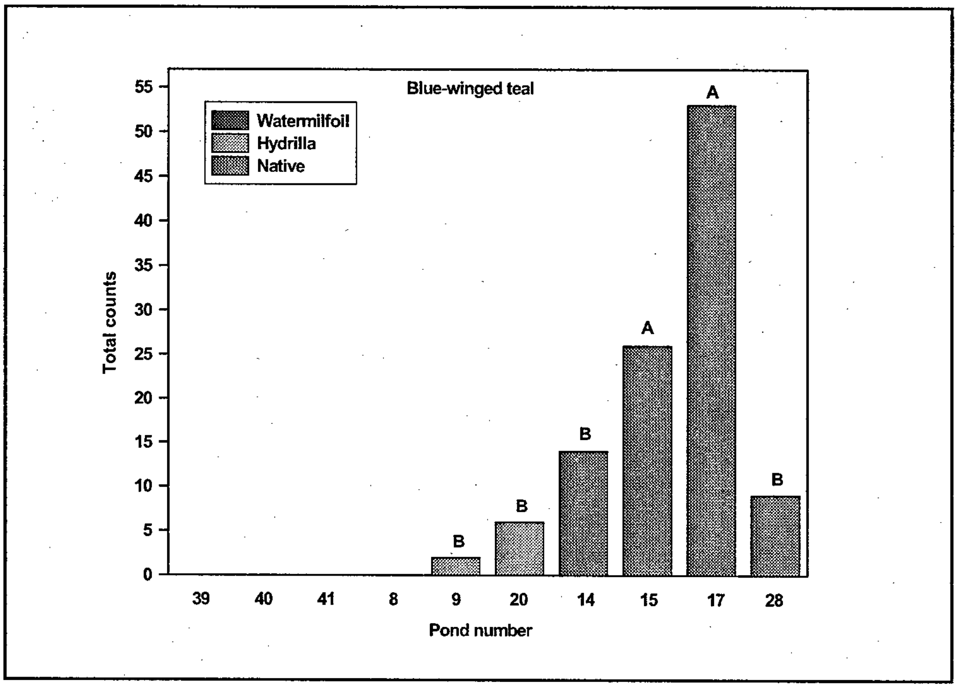

Figure 8. Blue-winged teal counts were highest in native ponds; the species was not observed in watermilfoil ponds or one hydrilla pond. Birds observed in ponds 9 and 20 (single observations) were associated with shoreline vegetation.

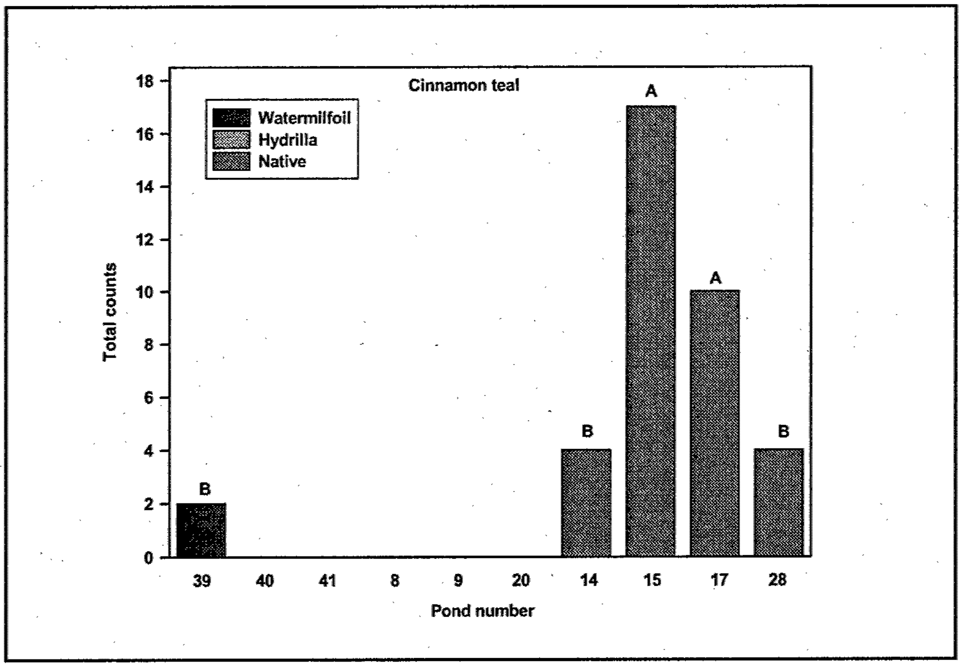

Figure 9. Cinnamon teal counts were highest in native ponds; the species was not observed in two watermilfoil ponds or any hydrilla ponds. Birds observed in pond 39 (single observation) were associated with an American pondweed colony

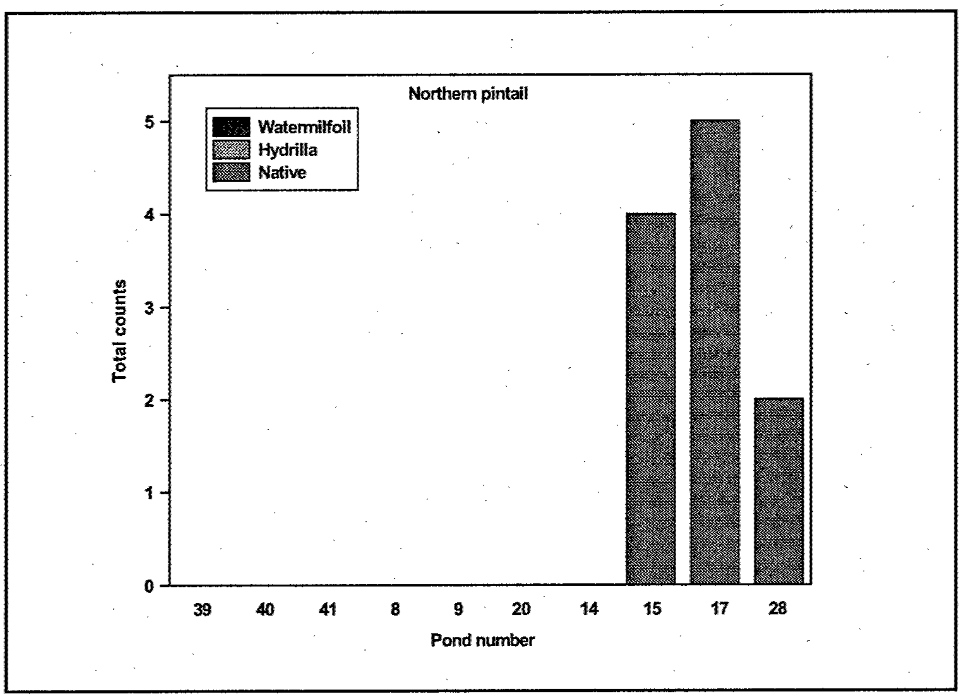

Figure 10. Northern pintail were observed only in native ponds

Most puddle ducks clearly selected native ponds over hydrilla and watermilfoil ponds, demonstrating that native vegetation (and/or associated organisms) provides the most suitable habitat among the three plant communities. In some cases, when puddle ducks were observed in hydrilla or watermilfoil ponds, the birds were associated with small colonies of native vegetation or with shoreline vegetation, rather than the dominant plant species. This further implies greater value of native plants as habitat for puddle ducks.

Diving Ducks. Diving ducks comprised 20.3 percent of observed waterfowl, with four species recorded, including ring-necked ducks (*Aythya collaris*), lesser scaup (*A. affinis*), redheads (*A. americana*), and buffleheads (*Bucephala albeola*). Of the 806 diving ducks observed, 82 percent were in native ponds, 3 percent were in watermilfoil ponds, and 15 percent were in hydrilla ponds (Figure 11). Higher frequencies of diving ducks in native ponds indicated preferences for native vegetation (and/or associated invertebrates) over exotic vegetation. The frequency in pond 20 differed from other hydrilla ponds; this was attributed to hawks perching on a power line adjacent to that pond.

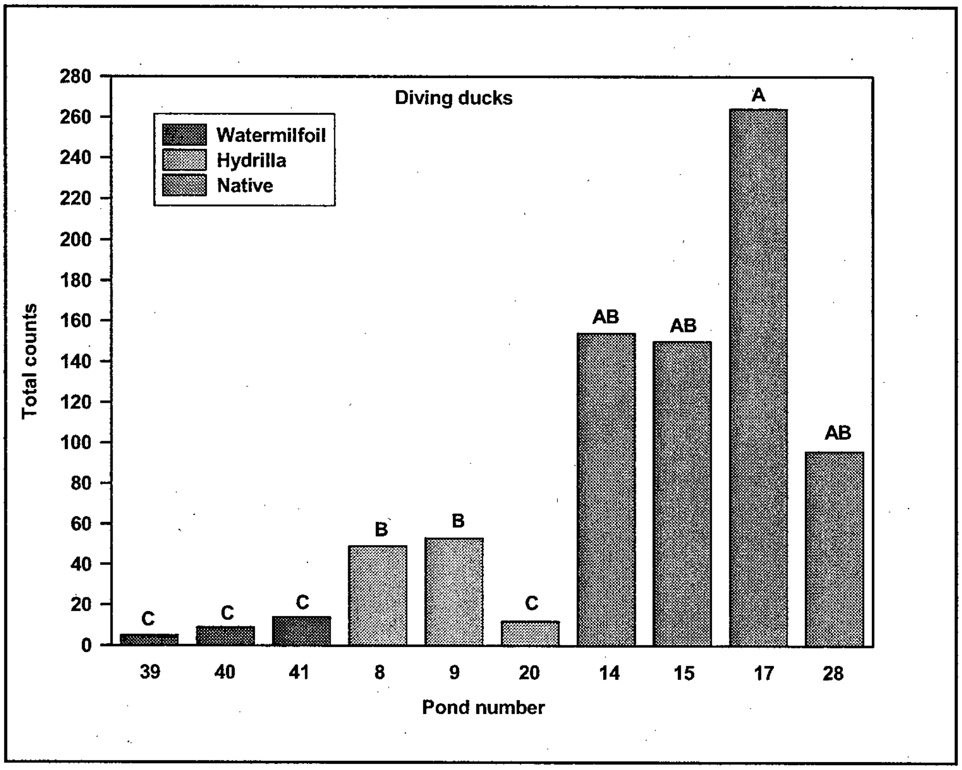

Figure 11. Diving duck counts were highest in native ponds and lowest in watermilfoil ponds. Relatively low abundance in one hydrilla pond (20) was likely due to hawks perching on a nearby power line

Figures 12 through 15 provide counts of four diving duck species observed during the study. Diving duck counts in native plant ponds were high, with all species recorded from most native ponds, generally at the highest frequencies for each. One species (redhead) was only observed in two native ponds (but in no other ponds). Watermilfoil pond selection by diving ducks was low. Only two of the four species were observed in watermilfoil ponds, and even then, counts were low. Hydrilla pond counts were low for most species, with only one (lesser scaup) occurring in relatively high numbers. One diving duck species (redheads) was not observed in hydrilla ponds.

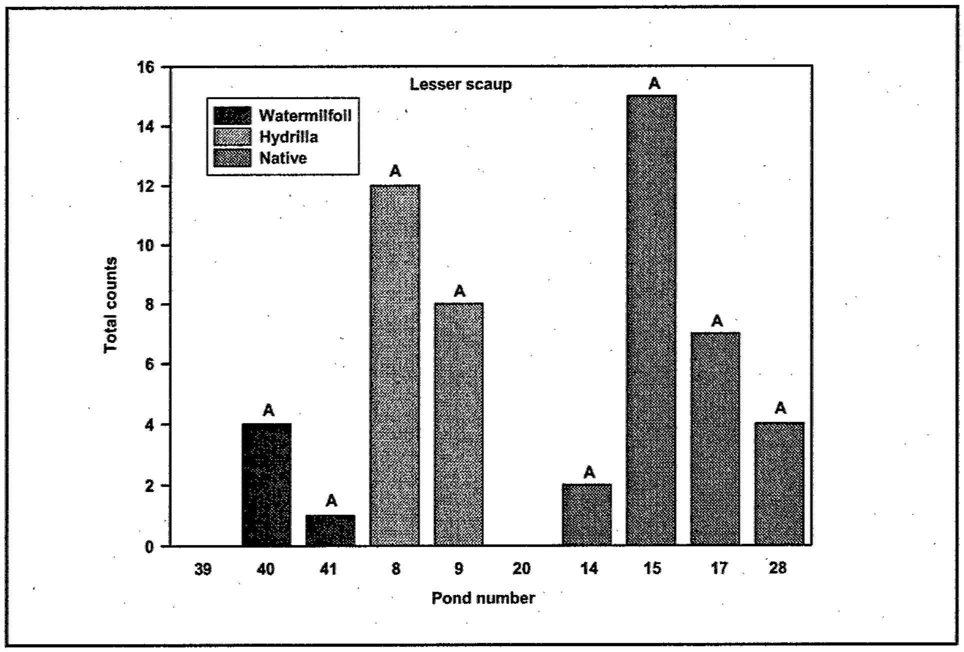

Figure 12. Lesser scaup counts were not statistically different among ponds in which they were observed, but were generally highest in native and hydrilla ponds

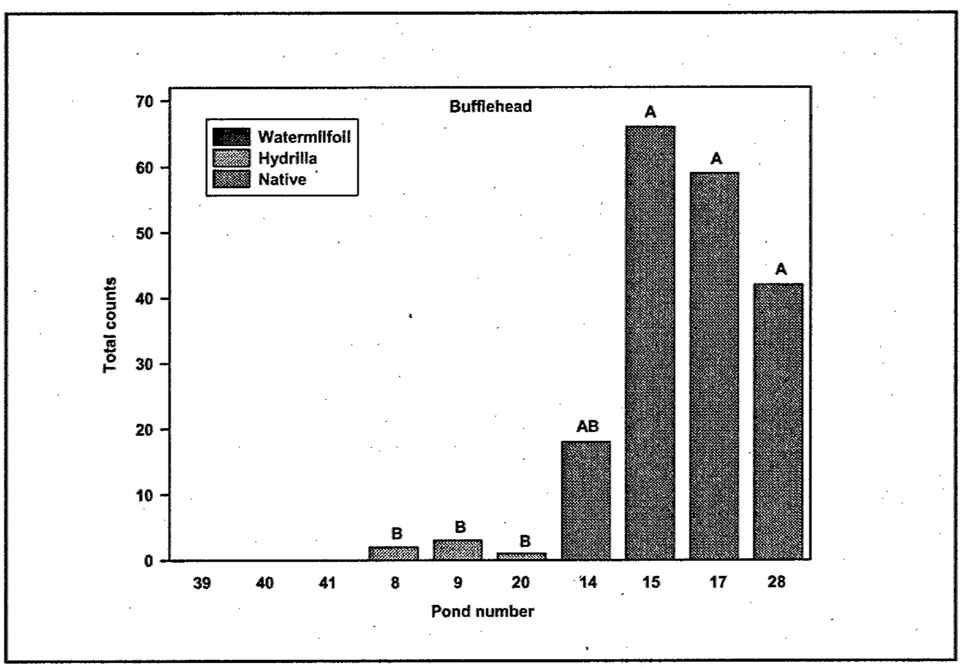

Figure 13. Bufflehead counts were highest in native ponds; the species was not observed in watermilfoil ponds

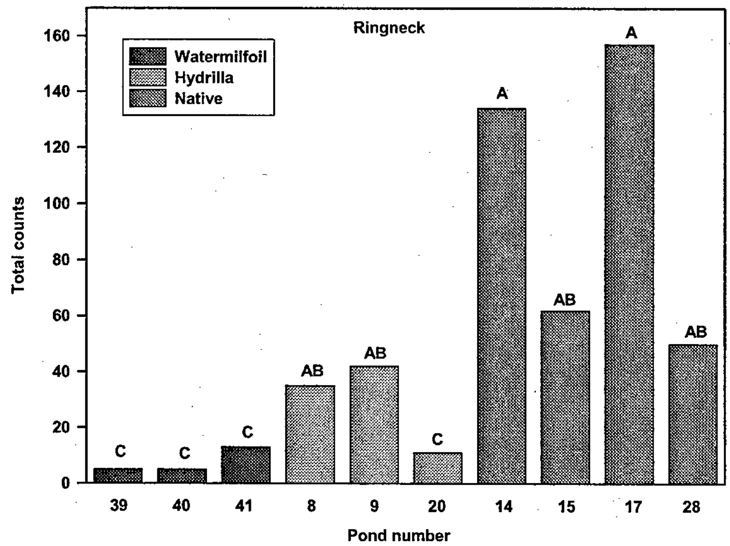

Figure 14. Ring-necked duck counts were highest in native ponds and lowest in watermilfoil ponds. A relatively low count from one hydrilla pond (20) was believed due to the proximity of power lines used as perches by hawks

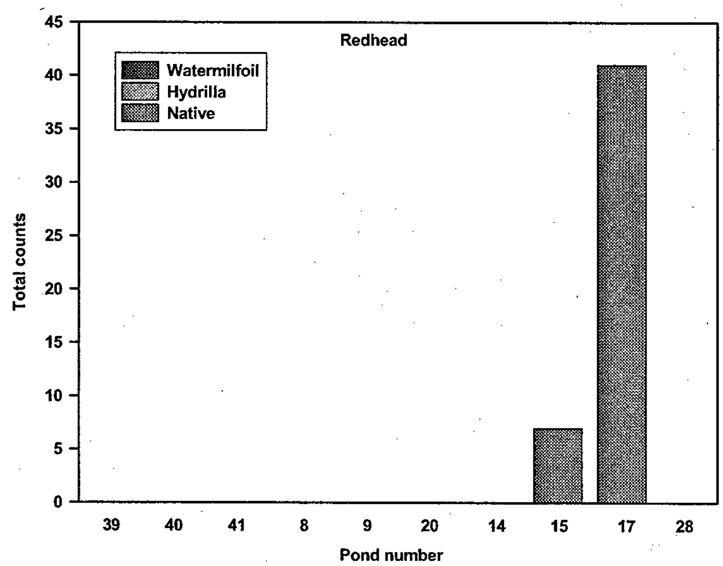

Figure 15. Redheads were only observed in two native ponds

Based upon total counts, most diving ducks selected native ponds over hydrilla and watermilfoil ponds, demonstrating that native vegetation (and/or associated organisms) provided the most suitable habitat among the three plant communities for these species. Diving ducks were most commonly observed in deeper portions of ponds, usually where open surface water occurred. Such areas were uncommon in hydrilla and watermilfoil ponds, possibly accounting for, at least in part, low preference by diving ducks: watermilfoil canopies persisted through late winter, leaving no open-water areas for diving duck species to feed. Low to moderate preference for hydrilla ponds may have also been related to the canopy. Hydrilla canopies persisted until midwinter: most diving duck observations in hydrilla ponds occurred after canopies had senesced. Native ponds exhibited open-water areas throughout the observation period, and were therefore more suitable for diving duck species throughout the study period.

CONCLUSIONS: Waterfowl prefer ponds dominated by native submersed and emergent vegetation. Although ponds dominated by watermilfoil and hydrilla were utilized, in many cases waterfowl in those ponds were associated with patches of native (emergent or submersed) plant species. If waterfowl at the LAERF selected ponds that were most beneficial to them, it appears that ponds supporting native aquatic vegetation provided the most suitable habitat. Although utilized, ponds supporting exotic plant communities were not prime habitat for waterfowl, and were shunned by some species.

Migratory waterfowl habitat might be greatly improved by including development of native aquatic plant communities in management strategies, many of which currently provide only flooded terrestrial vegetation or planted grains as a food source. While these techniques are of benefit to waterfowl, greater benefits may be achieved when incorporating sustainable habitat by means of native aquatic plant community establishment. The use of exotic aquatic species is discouraged (despite some waterfowl utilization) because of aggressive and dense growth, which reduces diversity and may restrict open water areas available to diving species.

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REFERENCES

Benedict, R. J., and Hepp, G. R. (1996). "Wintering waterbird use of two aquatic plant habitats in a southern reservoir," *J. Wildl. Manage.* 4(1):269-278.

Diggs, G. M., Jr., Lipscomb, B. L., and O'Kennon, R. J. (1999). *Shinners & Mahler's illustrated flora of north central Texas*. Botanical Research Institute of Texas, Fort Worth, TX.

Gould, F. W. (1975). "Texas plants--a checklist and ecological summary," Texas Agri. Exp. Sta., Texas A&M Univ., College Station, TX.

Haramis, G. M. (1991). "Canvasback." *Habitat requirements for Chesapeake Bay living resources*. S. L. Funderburk, J. A. Mihursky, S. J. Jordan, and D. Riley, ed., 2nd ed., Living Resour. Subcomm., Chesapeake Bay Program, Annapolis, MD, 17.1-17.10.

Heitmeyer, J. P., and Vohs, P. A.. (1984). "Distribution and habitat use of waterfowl wintering in Oklahoma," *J. Wildl. Manage.* 48(1):51-62.

Hobaugh, W. C., and Teer, J. G.. (1981). "Waterfowl use characteristics of flood-prevention lakes in north-central Texas," *J. Wildl. Manage.* 45(1):16-26.

Johnson, F. A., and Montalbano, F., Jr. (1989). "Southern reservoirs and lakes." *Habitat management for migrating and wintering waterfowl in North America.* L. M. Smith, R. L. Pederson and R. M. Kaminski, ed., Texas Tech Univ., Lubbock, TX, 93-116.

Jorde, D. G., Haramis, G. M., Bunck, C. M., and Pendleton, G. W. (1995). "Effects of diet on rate of body mass gain by wintering canvasbacks," *J. Wildl. Manage.* 59(1):31-39.

Keast, A. (1984). "The introduced submersed macrophyte, *Myriophyllum spicatum*, as habitat for fish and their invertebrate prey," *Can. J. of Zool.* 62:1289-1303.

Orth, R. J., and K. A. Moore, K. A. (1981). "Submerged aquatic vegetation of the Chesapeake Bay; past, present and future," *Trans. North Am. Wildl. Nat. Resour. Conf.* 46:271-283.

Paulus, S. L. (1982). "Feeding ecology of gadwalls in Louisiana in winter," *J. Wildl. Manage.* 46(1):71-79.

Smith, J. K. (2001). "Selection and use of aquatic vegetation by migratory waterfowl in north central Texas," Masters thesis, University of North Texas.

Sudgen, L. G. (1973). "Feeding ecology of pintail, gadwall, American widgeon, and lesser scaup ducklings in southern Alberta," Can. Wildl. Serv. Report Series Number 24.

White, W. M., and Malaher, G. W. (1964). "Reservoirs." *Waterfowl tomorrow.* J. P. Linduska, ed., U.S. Dept. Inter., Washington, DC, 381-389.

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